

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BOARD OF PATENT APPEALS AND INTERFERENCES**

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In re Application of:	)	
Nicole S. Carpenter et al.	)	
Serial No:	)	GROUP ART UNIT: 1763
10/798,816	)	
Filed:	)	EXAMINER: Ram N. Kackar
March 10, 2004	)	
For: CLEANING OF SEMICONDUCTOR	)	DATE: June 26, 2007
WAFERS BY CONTAMINATE	)	
ENCAPSULATION	)	

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Mail Stop Appeal Brief – Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**REPLACEMENT BRIEF FOR APPELLANT**

This is an appeal from the final rejection of the Examiner mailed November 21, 2006 rejecting claims 11 and 13-16 which are all of claims of the subject application. A Notice of Appeal and the appeal fee were timely mailed and received in the United States Patent and Trademark Office on February 26, 2007. The Appeal fee of \$500 for the original brief has already been charged to Deposit Account No. 09-0456.

In an Office Action mailed June 1, 2007, the Examiner objected to the Brief as defective under 37 CFR 41.37(c)(1)(v) for failing to properly identify parts of the specification which relate to the only independent claim 11. Appellant has corrected this

defect in the Summary Of Claimed Subject Matter in this Replacement Brief. Please charge any fees for this Replacement Brief to Deposit Account No. 09-0456.

#### **REAL PARTY IN INTEREST**

The real party in interest is the assignee of all rights in this application, International Business Machines Corporation, a corporation of the State of New York, having a place of business at Armonk, New York 10504.

#### **RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences known to Appellants, Appellants' legal representatives, or assignee, which will directly affect, or be affected by, or have a bearing on the Board's decision on this appeal.

#### **STATUS OF CLAIMS**

The subject divisional application was filed on March 10, 2004 with claims 11, 13-16, and 21-25. During prosecution of the application, a Restriction Requirement Office Action was mailed November 2, 2005 restricting claims 11 and 13-16, and claims 21-25. A Response to Restriction Requirement was filed November 28, 2005 electing claims 11 and 13-16. A non-final Office Action was mailed July 14, 2006 acknowledging the election of claims 11 and 13-16 and withdrawing claims 21-25. Claims 11 and 13-16 were still rejected. An Amendment was mailed October 16, 2006 amending claim 11 and

canceling claims 21-25. A Final Rejection Office Action was mailed November 21, 2006 still rejecting all the claims in the application, 11 and 13-16. A Letter After Final Rejection was mailed January 17, 2007, and an Advisory Action mailed February 15, 2007 indicated the Amendment mailed January 22, 2006 failed to place the application in condition for allowance. A Notice of Appeal was mailed on February 21, 2007 and received in the United States Patent and Trademark Office on February 26, 2007.

#### **STATUS OF AMENDMENTS**

No amendments have been filed after the Final Rejection and the rejected claims 11 and 13-16, as they presently stand, are set forth in the Appendix.

#### **SUMMARY OF CLAIMED SUBJECT MATTER**

The fabrication of electronic components such as integrated circuit semiconductors is very exacting and complex and requires a number of processing steps requiring extreme precision to form the desired circuit pattern on the component substrate. Typical semiconductor devices now have circuit line widths typically less than 0.5 micron with close spacing of the lines and via interconnections. Contamination of the semiconductor substrate in the form of particles on the substrate surface may cause short circuits, open circuits, and other defects which can cause the component to fail and/or adversely affect the performance of the component. For example, an individual particle as small as 100

angstroms in diameter can result in a defect in a modern microcircuit electronic component.

Cleaning the surface of the semiconductor substrate is therefore a critical step in integrated circuit fabrication and periodic cleaning of the substrate during the fabrication process is needed to maintain product integrity. There are currently numerous methods used to clean substrate surfaces in the electronic industry and basically water or solvents or chemical cleaning are used to remove contaminate particles and films from the surfaces. Chemical solutions are typically combined with megasonic or ultrasonic devices wherein the component to be cleaned is immersed in the chemical solution and the megasonic or ultrasonic devices used to impart high energy sonic waves to the surface of the component which in combination with the chemical solution removes organic films, ionic impurities and contaminate particles from the substrate surface.

Appellants have discovered an apparatus as defined in claim 11 and as shown in Figs. 1A-1F and as described in the specification starting on page 9, line 13 to page 10, line 10. Figs. 2A-2F are also exemplary for removing contaminant particulate matter from an integrated circuit semiconductor substrate surface. The substrate is positioned on substrate 16 and means are provided such as spin-on-coating to apply a sacrificial coating of a curable polymer on the surface of the substrate which curable polymer is to encapsulate and suspend the undesirable particles therein. The curable polymer may be fluidized if necessary. Energy forming means 14 are provided to dislodge at least some of the particulate matter 12 from the surface of the integrated circuit semiconductor substrate

such that the particulate matter is partially or fully encapsulated and suspended within the sacrificial curable polymer coating 13. Megasonic energy can be used as the energy forming means – see page 11, the Example. Means 15 are provided for curing the curable polymer sacrificial coating to form a cured polymer strippable film containing particulate matter. Means such as ultraviolet or heat 15 can be used for curing. Means are provided as shown in Fig. 1E (such as pulling) for removing the particulate matter containing curable polymer sacrificial strippable film providing a substrate surface having less particulate matter therein as shown in Fig. 1F and a stripped film containing the particulate matter.

Claims 13-16 all depend on claim 11.

It is respectfully submitted that the prior art does not disclose nor teach such an apparatus.

#### **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

- I. Claims 11 and 13-16 are rejected under 35 USC 103(a) as being unpatentable over Sayka et al. (U.S. Patent No. 6,766,813) in view of Malotky (U.S. Patent No. 5,120,369).

**ARGUMENT**

**Claims 11 and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sayka et al (U.S. Patent No. 6766813) in view of Lyle O. Malotky (U.S. Patent No. 5120369).**

Sayka et al is cited to disclose an apparatus for removing contaminate particulate matter from a semiconductor wafer and discloses a support (Abstract and Fig 1), energy (acoustic wave) forming means to dislodge particulate matter (Col 3, lines 1-20) and means to remove particulate matter (Col 4, lines 45-57).

The Examiner acknowledges that Sayka et al. fail to disclose means for applying a sacrificial coating of a polymer, curing and removal of particulate matter with it.

Malotky is cited to disclose an apparatus for removing material from a surface by spraying a polymer in solution or suspension which cross links to a film which is removable by stripping (Abstract).

The Examiner concludes it would have been obvious for one of ordinary skill in the art at the time of invention to have used strippable polymer material to encapsulate dislodged particles from the substrate of Sayka et al. in order to safely and completely remove contaminate particulate matter from the substrate.

The Examiner states in response to Appellants' arguments regarding the deficiency of Sayka et al, that it is noted that unobviousness cannot be established by attacking the references individually when the rejection is based on a combination of references. *In re Novak* 16 USPQ 2d 2041, 2043 (Fed. Cir., BPAI 1989); *EWP Corp. v. Reliance Universal*

*Inc.* 225 USPQ 20 (Fed. Cir. 1985); *In re Keller* 208 USPQ 871 (CCPA 1981); *Ex parte Varga* 189 USPQ 204 (PO BdPatApp 1973); *Ex parte Campbell* 172 USPQ 91 (PO BdPatApp 1971); *In re Scheekler* 168 USPQ 716 (CCPA 1971); *In re Young* 159 USPQ 725 (CCPA 1968); *In re Lyons* 150 USPQ 741 (CCPA 1966).

Further, quoted from Malotky

"A novel method and process for applying a tailor-made polymer film system a metal surface for the purpose of immobilizing and decontaminating hazardous chemicals from the said surface using a polymer that will take up the undesirable materials by solution, absorption adsorption and hold such undesirable materials in solid suspension with subsequent stripping of the polymeric material." clearly indicates particulate matter going in to polymer film which could be stripped.

Further, Appellants are reminded by the Examiner that the claims are directed to an apparatus and the cited prior art discloses beyond, what would be necessary to prove a prima facie case of obviousness.

Appellants acknowledge the Examiner's rejections and comments but respectfully submit that neither reference discloses nor teaches Appellants' invention whether taken singly or in any proper combination.

Firstly, Appellants respectfully submit that they are not attacking the references individually where the rejection is based on a combination of references and respectfully submit that neither reference discloses nor teaches an apparatus whereby contaminants are contained in a polymer film on the surface of a substrate, which polymer film is stripped

as a polymer film from the surface of the substrate thereby removing the contaminant particles from the surface of the substrate. After the stripping operation of Appellants' invention, a stripped film is obtained which contains the contaminant particles therein. It is respectfully submitted that neither reference discloses nor teaches this invention.

Regarding the Sayka et al. reference, it is respectfully submitted that any dislodged particles are washed away with a stream of cleaning fluid.

The Examiner acknowledges that the reference does not disclose means for applying a sacrificial coating of a polymer, curing and removing of particulate matter with the polymer. Sayka et al. only shows the use of acoustic waves to dislodge particles from the surface of a wafer which dislodged particles are washed away with a stream of cleaning fluid. As Sayka et al. notes at col. 4, the paragraph beginning at line 45, gravity and acoustic waves may cause most, if not all, particles to be removed from the surface of the wafer. There is however the need to assist and remove these particles with the use of a stream of cleaning fluid. A spray nozzle 60 is used which sprays the surface of the wafer and removes the acoustic wave dislodged contaminants. It is clear that there is no teaching of forming a polymer film on the surface of the wafer which contains the contaminant particles therein and which film is cured and removed as a film (stripped) whereby the film contains the contaminant particles.

Similarly, Malotky also teaches the washing away of a sacrificial coating to remove contaminant particles from the surface of a substrate. Malotky does disclose applying a polymer to a surface of a substrate to remove contaminants from the surface of the



substrate but this is where any relationship to Applicants' invention ends. It is clear from Malotky that the polymer system used to apply to the surface of the substrate must be easily decrosslinked so that the polymer film can be easily stripped and safely disposed of. See col. 4, line 10, et seq. In example 1, the sacrificial coating is applied to the surface of a substrate containing a toxic agent and stripping of the panels was done with a 5% Alconox in water solution. It is clear that a cured polymer film is not formed containing the contaminant particulate matter which film is then stripped as a film from the surface of a substrate.

Both references show the washing away of particles and not Appellants' invention which shows removing the contaminants in a polymer film which film is stripped from the surface of a substrate forming a stripped film containing particles and a clean surface.


It is Appellants' position that the references actually lead one of ordinary skill in the art away from the claimed invention and cannot therefore render it unpatentably obvious. *In re Dow Chemical Co.* (CAFC 1988) 5 USPQ 2d 1529. That the reference leads one of ordinary skill in the art away from the claimed invention is a significant factor to be considered. In the cited prior art it is again Appellant' position that the prior art only shows the washing away of particles from the substrate surface when the contaminants are in a polymer film as in Malotky or in Sayka which merely shows dislodging particles from the surface of the wafer which dislodged particles are washed with a stream of cleaning fluid. There is no disclosure or teaching in the references to remove the contaminant particles as a film in a stripped film as claimed by Appellants.

**SUMMARY**

It is respectfully submitted that the prior art does not disclose nor teach Appellants' invention under 35 USC 103.

Accordingly, for the reasons given above, Appellants respectfully submit that the claimed invention, as a whole, is not obvious over the cited prior art and that claims 11 and 13-16 are patentable. The Final Rejection should be reversed and the claims should be allowed to issue.

Respectfully submitted,

  
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## CLAIMS APPENDIX

### Pending Claims of U.S. Serial No. 10/798,816

1 1.-10. (Canceled)

1 11. (previously presented) An apparatus for removing contaminate particulate  
2 matter from a contaminate particle containing integrated circuit semiconductor  
3 substrate surface comprising:

4 a support for supporting an integrated circuit semiconductor substrate  
5 containing undesirable particulate matter on the surface of the substrate;  
6 means for applying a sacrificial coating of a curable polymer on the surface of  
7 the substrate, which curable polymer is to encapsulate and suspend the  
8 undesirable particles therein;

9 means for fluidizing the curable polymer if necessary;

10 energy forming means to dislodge at least some of the particulate matter from  
11 the surface of the integrated circuit semiconductor substrate into the fluid  
12 curable polymer sacrificial coating such that the particulate matter is  
13 partially or fully encapsulated and suspended within the sacrificial curable  
14 polymer coating forming a particulate matter containing curable polymer  
15 sacrificial coating;

16 means for curing the fluidized particulate matter containing curable polymer  
17 sacrificial coating to form a cured polymer strippable film containing the  
18 particulate matter; and

19 means for removing the particulate matter containing curable polymer  
20 sacrificial strippable film from the surface of the substrate as a strippable

21 film providing a substrate surface having less particulate matter therein and  
22 a stripped film containing the particles.

1 12. (Canceled)

1 13. (previously presented) The apparatus of claim 11 wherein the sacrificial  
2 coating curable polymer is a fluid.

1 14. (Original) The apparatus of claim 11 wherein the energy is sonic energy.

1 15. (Original) The apparatus of claim 11 wherein the energy means is thermal,  
2 centrifugal, magnetic or vibrational.

1 16. (previously presented) The apparatus of claim 11 wherein the sacrificial  
2 coating curable polymer is a liquid.

1 17.-20. (Canceled)

1 21.-25. (canceled)

## **EVIDENCE APPENDIX**

None

## **RELATED PROCEEDINGS APPENDIX**

None